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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,553	05/02/2006	Vitali Nesterenko	0321.68367	3552
24978 7590 09/17/2009 GREER, BURNS & CRAIN 300 S WACKER DR 25TH FLOOR CHICAGO, IL 60606				
EXAMINER STARK, JARRETT J				
ART UNIT 2823		PAPER NUMBER		
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary**Application No.**

10/531,553

Applicant(s)

NESTERENKO ET AL.

Examiner

JARRETT J. STARK

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 August 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SF/ICE)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Arguments

Applicant's arguments directed to the newly amended claims filed 8/5/2009 have been fully considered but they are not persuasive.

Applicants repeat the arguments that it would not be obvious to one of ordinary skill in the art to replace the means of applying pressure in Bhat with the functional equivalent means of applying pressure disclosed by Cohn. See remarks in the Actions mailed 6/30/2009 and 3/5/2009.

This argument is traversed in view of the following rationale:

Bhat et al. discloses a the method of thermal compression bonding semiconductor wafers comprising the steps of first bringing together cleaned wafers creating a weak bond within a chamber and then further bonding the wafer though means of applying heat and pressure. As in Applicant's invention, the purpose of invention is to thermally bond semiconductor wafers.

Bhat et al. is silent upon the use of isostatic pressure when applying the required pressure during thermal compression bonding, as required by the independent claims.

For such a teaching, the Examiner relies on Cohn et al., which discloses isostatic pressure is a functional equivalent alternative for applying the necessary pressure for thermal compression bonding. Coh et al. states:

"Still another alternative for supplying the necessary pressure and heat is to place a substrate pair into a high-temperature bag (made of a material such as polyimide or metal foil) and subject it to hot -isostatic-pressing."

NOTE: Cohn is merely cited to show functional equivalent means of applying heat and pressure.

The foregoing means of applying pressure for thermal compression boning includes Bhat et al.'s means of applying pressure by pressing the two wafers together for the thermal compression bonding (Bhat et al. col. 2, Ln 28-48) in addition to alternative of applying isostatic pressure, which satisfies the claim language.

The Examiner's position is that it would have been within the scope of one of ordinary skill in the art at the time of the invention to combine the teachings of Bhat and Cohn to enable the pressure step of Bhat to be performed according to the teachings of Cohn because one of ordinary skill would have been motivated to look to alternative suitable methods of performing the disclosed pressure step of Bhat and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP § 2144.07.

Replacing Bhat et al.'s means for applying compressive pressure with Cohn et al.'s alternative means for applying the compressive pressure would have been prima facie obvious.

The artisan would have been motivated to find a way to create stronger and/or more efficient bonds when using Bhat et al.'s method, which employs compression by pressing. See *Dystar*, 464 F.3d at 1368 (an implicit motivation to combine exists when the "improvement" is technology-independent and the combination of references results in a product or process that is "stronger, cheaper, cleaner, faster, lighter, smaller, more durable, or more efficient.") (emphasis added).

Cohn et al. teaches the functional equivalence of compression by pressing and compression by isostatic pressure, which satisfies the claim language. The fact that Cohn et al. compressing means includes the compression means used by Bhat et al. to perform the same type of bonding, also might be capable of bonding Bhat et al. semiconductor wafers. Furthermore, the total number of means for applying pressure disclosed by Bracken constitutes "a finite number of identified, predictable solutions," as is required to demonstrate obviousness using an "obvious to try" rationale. *KSR*, 127 S. Ct. at 1742. We therefore find that the artisan would have been motivated to try Cohn et al.'s means for applying compressive pressure, including the isostatic pressure, in order to determine whether any of them yields a reduction in the bonding time and/or a increase in strength and efficiency of the bond. See *KSR*, 127 S. Ct. at 1742 ("When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp."). The claimed invention therefore would have been prima facie obvious over Bhat et al. in view of Cohn et al.

NOTE: For additional references (not used for basis of rejection at this time) disclosing the notoriously well known step of using isostatic pressure to bond wafers, see attached notice of references. The additionally cited references, demonstrate numerous examples of isostatic pressure to bond wafers and disclose the functional equivalence to directional pressure.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhat et al. (US 5,207,864) in view of Cohn et al. (US 7,276,789 B1).

Regarding claim 1, 11, 12, 14-16, 19, Bhat et al. discloses a method for semiconductor wafer bonding, the method comprising steps of:

- providing semiconductor wafers to be bonded (Bhat, Abstract);
- cleaning the surfaces of wafers to remove particle and chemical contaminants and provide bonding surfaces comprised of the entire surface of the wafers (Bhat, Abstract);

bringing the bonding surfaces of the wafers into direct contact with each other to weakly bond the wafers to each other (Bhat, Abstract (i.e. "van der Waals force");

placing the wafers in a pressurization chamber (Bhat, Abstract);

applying bonding pressure to the wafers (Bhat, Col. 6 lines 3-11);

heating the wafers during said step of applying bonding pressure (Bhat, Abstract); and

controlling and maintaining said steps of heating and applying bonding pressure for a period of time to substantially strengthen bonding between the wafers (Bhat, Col. 6 lines 3-11);

Bhat et al. does not specify that the pressure is applied solely through isostatic pressure. It was however known to those of ordinary skill in the art to solely apply an isostatic type of pressure when bonding wafers. At the time of the invention it was conventional use hot press bonding as well as Hot Isostatic Press or Hot Isostatic Processing (HIP) diffusion bonding. HIP is known conventional means of applying evenly controlled pressure. It would be obvious to one of ordinary skill in the art to select isostatic means for applying pressure when bonding wafers. For an examples of one of ordinary skill in the art applying isostatic pressure when performing a diffusion bonding process see Cohn et al. (entire document).

"Still another alternative for supplying the necessary pressure and heat is to place a substrate pair into a high-temperature bag (made of a material such as polyimide or metal foil) and subject it to hot -isostatic-pressing."

It would have been within the scope of one of ordinary skill in the art at the time of the invention to combine the teachings of Bhat and Cohn to enable the pressure step of Bhat to be performed according to the teachings of Cohn because one of ordinary skill would have been motivated to look to alternative suitable methods of performing the disclosed pressure step of Bhat and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP § 2144.07.

When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. KSR Int'l Co v. Teleflex Inc.

Regarding claim 2, Bhat_in view of Cohn disclose the method of claim 1, further comprising steps of: cooling the wafers; and removing the wafers from the pressurization chamber (Bhat, Col. 6 line 10).

Regarding claim 3, Bhat_in view of Cohn disclose the method of claim 2, wherein said step of cooling is conducted while said step of controlling and maintaining continues said step of applying bonding pressure, followed by a step of depressurization (Bhat, Abstract).

Regarding claim 4, Bhat_in view of Cohn disclose the method of claim 1, wherein said step of controlling and maintaining comprises: creating a temperature ramp and a pressure ramp to substantially strengthen bonding between the wafers (Bhat, Entire document—the process disclosed by Bhat is to improve bonding which implicitly mean to strengthen bonding);

Regarding claim 5, Bhat_in view of Cohn disclose the method of claim 4, wherein said step of controlling and maintaining creates the temperature ramp as a function that is independent from the pressure ramp (Bhat, Abstract).

Regarding claim 6, Bhat_in view of Cohn disclose the method of claim 1, wherein said step of heating commences prior to said step of applying pressure (Bhat, Abstract).

Regarding claim 7, Bhat_in view of Cohn disclose the method of claim 1, wherein said step of heating commences with or after said step of applying pressure (Bhat, Abstract).

Regarding claim 8, Bhat_in view of Benavides and/or Curbishley disclose the method of claim 1, wherein said step of cleaning creates hydrogen terminated surfaces at the semiconductor surfaces to be bonded (Inherent result of HF dip).

Regarding claim 9, Bhat in view of Cohn disclose the method of claim 1, wherein said step of bringing creates one of a Van der Waals and Hydrogen bond (Bhat, Abstract).

Regarding claims 10 and 13, Bhat in view of Cohn disclose the method of claim 9, wherein said step of bringing brings the semiconductor surfaces to be bonded into direct contact with each other with or without an intervening layer (direct and indirect bonding are known in that art. The selection of the two types of bonding, indirect or direct bonding, is a matter of design choice which is dependent upon the materials which are being bonded. One of ordinary skill in the art would be able to select one of the two known process on the base of its suitability

Regarding claim 17, Bhat in view of Cohn disclose the method of claim 1, wherein said steps of providing, cleaning and bringing are repeated to form a plurality of weakly bonded pairs of wafers and said steps of applying, heating, and controlling and maintaining are carried out with the plurality of weakly bonded pairs of wafers simultaneously in the pressurization chamber (Bhat, Abstract).

Regarding claim 18, Bhat in view of Cohn disclose the method of claim 1, further comprising, prior to said step of placing, loading said wafers in an unsealed container, and wherein said step of placing is carried out by placing said unsealed container in said pressurization chamber (Bhat, Abstract).

Regarding claim 20, Bhat_in view of Cohn disclose the method of claim 19, further comprising a step of controlling said heating and pressing to induce strain in at least one of said wafers (inherent result of heat/pressure bonding process).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JARRETT J. STARK whose telephone number is (571)272-6005. The examiner can normally be reached on Monday - Thursday 7:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jarrett J Stark/
Examiner, Art Unit 2823

9/10/2009
/J. J. S./
Examiner, Art Unit 2823